TITLE

ENERGY SAVING AUTOMATIC WINDOW SYSTEM OBTAINED BY USING SOLAR ENERGY DURING THE COLD SEASON, CONTROL OF SOLAR RADIATION IN SUMMER, THERMAL INSULATION, CONTROLLED INTERNAL INCIDENCE OF LIGHT, CONTROLLED AIR EXCHANGE

DESCRIPTION

The state of the art for different advancements, e.g.: DE 296 24 245 U1; EP 0978617B1 includes designs, which enable on the one hand a mechanism for the parallel opening of the casement or, on the other hand, the use of sun energy during the winter, e.g. IT 01/00026. The invention has the object of creating pre-conditions, which are necessary for an efficient control of the climate and temperature of a building, which is decisively influenced through the presence of glass surfaces. This is guaranteed through the application of a design, which uses simple components and mechanisms. The window system consists of a frame, which also fulfils the function of a counter-frame and/or the support frame of the building, an outer and an inner window casement, which are glazed and, in themselves, are independent of each other, as well as a mechanism with the characteristic of opening and closing the above-named window casements independently of each other. Each of these two window casements consists of a profile with a variable heat transition efficient of preferably U = 0.8 to 0.6 W/m²°K. The outside glass consists of insulated insulating glass with suitable physical and optical characteristics, a variable heat transition efficient of preferably U = 1.6 to 1.1 W/m²°K, as well as a variable transparency coefficient of preferably 68% to 77% with the corresponding transmission of sun energy. In the inside of the outer insulating glass is a blind or a type of curtain on rolls, consisting of a material with variable thermal conductivity of preferably Lambda 0.014 to 0.0126 W/m°K. The blind, as well as the curtain are driven by a motor. The inner glass insulation consists of insulating glass with suitable physical and optical characteristics and has a variable heat transition coefficient of preferably U = 0.6 to 0.3 W/m²°K. For both individual insulating glass units, there are spacers required which – compared to other systems - change the thermal conductivity in such a way, that it is possible to achieve better insulation along the perimeter of the insulating glass. The entirety of the illustrated solutions presents a window system, which – depending on the external

climatic conditions – creates a better indoor climate. Usually, it is as follows: that during the wintertime, when the sun shines on the glass surfaces of a building, the outer window casing with the movable blind or the rolled up curtain stays closed, while the inner window casing can be opened parallel towards the inside. The sun's energy, which enters through the outer insulated glass, first of all warms up the inside of the window and then, via convection, warms up the air near the glass surface and, in turn, the entire room. One part of the sun's energy goes straight through both glass surfaces, which inevitably warms up the room in a direct way.

During the summer and in order to control the solar radiation, the inner window casement stays closed to guarantee the insulation, and the outer window casement - with the blind or the curtain rolled down – will be opened to the outside. In this way, the open window casement forms a barrier against the solar radiation. The separation of the outer and inner glass enables the direct and complete release of heat, which is collected on the outside glass, to the air on the outside, so that the inner insulated glass warms up.

The heat insulation of the window is at its best, when both window casements - with the blind or the curtain down – are fully closed and as far as the circumstances allow, the previously described measures are carried out. The fact that the blind or the curtain are down, makes it possible to improve and guarantee the thermal insulation of the outer insulated glass.

During the cold season and when both window casements are closed, the window insulation can be improved through the following solution, which influences the thermal conduction inside the window casements. The above-mentioned solution is intended for the installation in a pipeline along an inner side wall and visible between both insulating glass units. This pipeline contains a liquid, which is normally used in heating and cooling elements, and has two connecting parts in two places, which run through the frame. This application is only justifiable, if the energy necessary for it, can be taken from known or renewable energy sources, e.g. from the storage of a solar unit or from passive existing heat sources from pipelines underneath the ground, or from below the building where – as it is known – there are liquids of suitable temperatures and quantities, or from a combination of both possibilities. This solution warms up the air between both insulating glass casements, which results in a better insulation of the inner insulating glass casement and the surrounding components of the window.

Therefore, the contribution of the solar energy, which is necessary to change the thermal flow of the insulating glass units, depends also on the thermal transition coefficients of the glazes

inner and outer casements when these are closed or the existence of such conditions, which are required. The exchange of air is achieved by the fact, that for a certain period of time, one window casement opens to the outside and the other towards the inside of the building. The incidence of light is controlled by the motor-driven blind and/or the relevant curtain on rollers inside the inner insulating glass unit. All possible positions of both window casements (open / closed) are programmable; so are the climate data, which is received via sensors on the inside and outside of the windows. The processed data is also used for the control mechanism for manoeuvring to the required positions.

In the following, the invention is described in an example using the enclosed illustrations, which are:

FIG. 1 – a front view of the windows with the relevant frame, casements, motor shaft, driving motors, levers, connecting bars and multiple hinges;

FIG. 2 – a B-B sectional view of the windows with the above-mentioned window casements, levers, multiple hinges in an open position, as well as levers and multiple hinges in a closed position, shown through a broken line;

FIG. 3 – a A-A sectional view of the mentioned frames or counter-frames, window casements, inner and outer glass with special connection profile between the glass surfaces and the casements, parts of the moving mechanism and parts of the components controlling the thermal flow;

FIG. 4 – a view of the levers and their connection due to connecting rods;

FIG. 5 – a view of the levers and their connection via parallel arranged ropes or profile rods;

FIG. 6 – a view of the levers and their connection via toothed racks;

FIG. 7 – a view of two lever systems and their connection via parallel arranged ropes or profile rods.

One particular feature of the windows is that the frame and the window casements are completely arranged on the inside, between the insulating glass. Therefore, the heat conductivity, which is influenced through the frame and the window casements, is increased, because they are covered through the insulating glass, which adds insulation through the glass panels to the specific insulation of the frame and the window casements.

For better and total energy saving, plus maximum insulation through covering the frame and the window casements through glass panels, the ventilator mechanism is placed inside the unit and visible between both window casements. This solution enables the homogeneity of the entire perimeter, the frame parts, window encasements and the glass panels, without superimposed mechanisms for the automatic opening. Also through the positioning of the pipelines for the warming up and/or cooling down of the inside of the windows, which is visible through both glass panels, the homogeneity of the frame parts, window casements and glass panels are not impaired. A further aspect of energy saving is achieved due to using electric engines, which consume only a little electricity. This solution requires the use of multiple hinges, which hold the weight of the window casement during the opening and closing phase, which otherwise would be carried by the electric engines, in order to keep down electricity consumption.

DETAILED DESCRIPTION

The frame consists of a rolled I (fig. 3; 2; 1) 10 or U profile, which stretches over the entire perimeter. The profile is designed to incorporate the complementary volume formed into the resulting hollow space, which is restricted by the configuration as a I or U or the configuration as a L, C or T. The I profile has to fulfil the task of the frame and the counter frame and can also represent the support structure of the building. A hollow space of the I profile, in which there is a window casement (fig. 3; 2) 11, is towards the outside of the building, which – as a wopening – forms the outside of the window. The outer insulating glass (fig. 3; 2) 14 with the motor-driven blind (fig. 2) 15 in the inside, is fixed with a special profile onto the window casement (fig. 3; 2; 1) 12. The result is that the outer insulating glass conceals the window casement and the window casement conceals the frame. Opposite and symmetrical, inside the hollow space of the I profile, is a window casement, which forms the entire inside of the window (fig. 3; 2; 1) 11; 11a. The inner insulating glass (fig. 3; 2) 13 is linked to the window casement by a special profile (fig. 3; 2) 12. This enables the inner insulating glass to conceal the window casement and the window casement conceals the frame. The inner window casement forms a unit consisting of two components: one part functioning as a frame (fig. 3; 2) 11 and on the other side (fig. 3; 2; 1) 11a, with insulating glass, the opening part of the window. If the inner window casement is completely opened manually, it enables cleaning of the inner glass panels, access to the opening

mechanism, the direct release of the solar energy into the room, a better light transmission, as well as an increased exchange of air, in case the outer window casement has also been opened.

All window casements are provided with suitable safety mechanisms and standard catches and gaskets. For the manually opened window casement, a simple opening and closing mechanism is intended to be used, which has not been graphically illustrated. It should consist of snap-in pins and a holding lever, which are fixed to the specific profile in a suitable place.

The mechanism of the automatic window system consists at least of: two independent drive shafts (fig. 3; 2; 1) 16, two independent driving motors (fig. 3; 2; 1) 17, eight levers of the same size (fig. 3; 2; 1) 19; 20 plus four connecting rods (fig. 3; 2; 1) 21, four multiple hinges (fig. 2; 1) 30-31, which support the weight of the outer and inner window casements. The drive shafts (fig. 3; 2; 1) 16 end on both sides in a holder (fig. 3; 1) 22, which is supplied with a receptacle, in order to permit movement in the shafts in both directions. The holders 22 are fixed to the frame.

The drive shafts with the ability to move independently (fig. 3; 2; 1) 16 are arranged in parallel. Each drive shaft is fixed firmly to two levers, (fig. 1; 2; 3) 19. The rotation surface runs at right-angles to the axle of the drive shaft. An independent driving motor 17 is connected to each drive shaft (fig. 1; 2; 3), which is fixed to the frame. From the frame or the counter-frame to the drive shaft, the order of components is as follows: on one end is the holder of the drive shaft, which is connected to the frame; the opening lever, which is connected to the driving shaft, as well as the driving motor, which is connected to the continuous drive shaft.

All levers have three different openings on the surface of the rotation level. Two openings are in one place, defined here as at the lower end of the lever, and one opening at the upper end. Four of these levers (fig. 3) 19, two for each drive shaft, serve for one of the two openings at the lower end of the drive shaft (fig. 1; 2; 3; 4) 19 and the other, second opening serves for fixing a rotating pin 23 to which a connecting rod 21 is connected in order to transmit movement. From the remaining four levers, defined here as auxiliary levers (fig. 1; 2; 4) 20, one of the two openings at the lower end serves for fixing a rotating pin 24, which is connected to a rotating bracket, which in turn is connected to one of the frames. The other, second opening is used for fixing a rotating pin 23, which in turn is fixed to the connecting rod 21.

On each of the connecting rods, on each of their ends, at right-angles to the moving direction of the connecting rod, there is a pin. The connecting rod determines the coupling of both levers (fig. 1; 2; 4) 19; 20. The end of the connecting rod is connected with the lever 19,

which in turn is connected to the drive shaft 16. The other end is connected to the auxiliary lever 20. The connecting rods (fig.1; 2; 3; 4) 21, two each for one window casement and on the side positioned to the vertical side of the windows, transmit the movement of the levers, which are connected to the drive shaft and to the auxiliary levers, which are controlled from the end of the connecting rods through rotating pins 23. This is possible by starting the movement of opening lever (which is connected to the drive shaft) through the driving motor. This results in a rotating movement of the drive shaft. The opening levers move the auxiliary levers and create the same rotating movement of the auxiliary levers around the swivel fixed pivot bracket (fig.1; 2; 4) 24.

As an alternative to connecting rods, the connection for the opening/closing levers can be done as follows:

a) – (fig. 5) Via parallel arranged ropes or profile rods 37; 38. At the lower end of the lever 19; 20 and near the rotation centre, there are two openings. They are situated in specific places along the surface of each lever. Inside the openings, there are parallel positioned ropes of profile rods 37; 38, which are connected to the lever via rotation pins 35; 36. The result makes it possible to transfer the movement of the drive shaft lever 16 onto the auxiliary lever 16. This happens through the tension / pressure of the ropes or profile rods 37; 38 during the rotating phase of the lever in both directions around the swivel, fixed pivot bracket 16; 24.

- (fig. 6) Through a system consisting of toothed rack and pinion [gear] 39.

Using the position of drive shaft 16, keeping its relevant storage, and with gear 17, a pinion [gear] 40 is fixed to the lever of the drive shaft. The drive shaft runs through lever 19 and the pinion [gear] 40. On the opposite side, an identical toothed wheel 40 is fixed to the auxiliary lever 20. The auxiliary lever and the toothed wheel are fixed to the frame with a rotating pin 24. The toothed rack is fixed to the frame by special holders 41, which make shifting and a feed motion of the toothed rack possible, in both directions along the connecting rod. The toothed rod does not incorporate any amendments of the systematic construction and the amounts as arranged for the connection rods. The toothed rod clicks on the one side into the pinion of the drive shaft lever and on the other side into the pinion of the auxiliary lever. The driving motor brings forth a rotating motion of the drive shaft, which begins to move the pinion of the drive shaft lever and results in a movement of the toothed wheel along its own axle. This results in the movement of the pinion of the auxiliary lever, which is transferred to the lever of the swivel fixed pivot bracket.

Without exemption, all levers (fig. 1; 2; 4) 19; 20 have a opening on their upper end, on the same place relating to the rotation centre. Inside this opening there is a rotating pin 25, which is connected to a sledge 26. Both are connected to the lever. The sledge is intended for a sliding movement in a guide block 27. The guide blocks 27 are fixed to the sides of the window casements and near the sledge, are connected to the relevant levers.

According to an alternative design style of the sledge and the guide block (fig. 5; 6), a moving roll 42 is put in, which is movable along a profiled guide block 43, fixed on both ends to the two holders on the window casements 44.

In order to guarantee the feed motion of the window casements on parallel levels and at right-angle to the level of the frame, the solution offers an auxiliary mechanism, which consists of multiple hinges (fig. 1; 2) 30-31. The drive shaft, set in motion by the driving motor, moves in both directions around its axle and results in the movement of four levers, of which there are two fixed to the drive shaft and two auxiliary levers. Through the force produced by the levers (fig. 1; 2; 4) 19; 20 and put onto the sledge 26, the sledge moves on the guide blocks 27 and at the same time the centre of the openings, which are at the upper end of the lever on the opposite side of the rotating axles of the levers, move on a parallel level to themselves outwards and keep the parallel position on the level of the window casements. This solution makes it possible to move the window casement a little at a time and, thus, to open / close the window casement, either independently or both at the same time.

The support mechanism (fig. 1; 2) for the opening of the window casement requires four multiple hinges 30-31, two for each window casement, which are positioned in the upper visible inside area of the casement near the auxiliary levers, as well as on the frame and the counter-frame and the window casements.

Every multiple hinge 30-31 consists of two holders 28; 29, two straight elements, which we will call ‘wings’ 30; 31, and three rotating pins 32; 33; 34, which hold the hinge together. The holders 28; 29 are connected on one end to the frame and the window casement. At the other end, the holders have continuous openings. There are continuous openings on both ends of the wings. The holder 28, which is connected to the frame, is connected on one end to the wing by a rotating pin 32, which is set into the continuous openings. The other end of the so-called wing 31 is connected to the end of the second wing 32 by a second rotating pin 33, which is called a central pin and which is set into the relevant continuous openings. The other end of the

second wing 30 is connected to the other holder 29, which is fixed to the window casement, through a third rotating pin 34, which sits in the relevant continuous openings. The multiple hinges enable several movement positions, which occur via different axles. The rotation of the multiple hinges (which consists of three elementary joints, of which one is fixed firmly to the frame) results in a horizontal movement, which is used to open and close the window casement. The force needed for moving the multiple hinges and the window casement, comes from the auxiliary levers 19, which are put in motion through the drive shaft 16 via the driving motor 17. In addition, the multiple hinges are a mechanical linkage, which – together with the levers – guarantee a movement of the window casements parallel on the level of the frame.

During the closing of the window casement, the multiple hinges are compact. During the opening of the same, they open like a book by positioning themselves at right-angles to the level of the frame. The straight elements called ‘wings’, from which the multiple hinges are made, are sufficiently large to enable the window casement to open completely.

Another mechanical system (fig. 7), which has the same purpose and function as the previous one and which enables the opening and closing of window casements, is built as follows: two holders, three levers and five joints. Altogether, these components form a ’lever system’. Each ’individual lever’ of the previously described system is replaced by a ’lever system’, so that every window casement has at least four ‘lever systems’. This solution does not require the use of multiple hinges, sledges and guide blocks or swivel-joint roller bearings and profile guides. The main task of this mechanical system is to keep the configuration and intended execution of the previous model with the ’individual levers’ and to ensure the connection between the individual lever systems through drive shafts, connecting rods, toothed rods, parallel arranged ropes or profile rods. The lever system (fig. 7) consists of a special holder 45, which is fixed to the frame. Inside this device, there is a drive shaft 16, which in turn is inside a sliding bearing, which enables the rotation of the drive shaft in both directions. Near the holder 45, there is the first lever 46 or action lever, which is fixed firmly to the drive shaft, i.e. with the rotating level at right-angles to the rotation axle of the drive shaft. At a specific place of the holder 45, which is fixed to the frame, there is a second lever 47, which is connected on one end with the holder through a rotating pin 49. The opposite ends of the action lever 46 and lever 47, which is fixed through a rotating pin 49 with the holder to the frame, is connected at two different points with a third lever 48 through rotating pins 50; 51. Lever 48, which is connected

to other before-mentioned levers, is fixed on one end through a rotating pin 52 to a holder 53 at the window casement. Every drive shaft 16 is connected to two primary levers 46 or the action lever. The drive shaft itself is connected to an independent driving motor, which is fixed to the frame. All levers in this system are arranged in such a way, that with each rotation of the drive shaft (to which the action lever is firmly fixed) and through the interaction of the levers and their connections, a simultaneous movement of the three levers of this system occurs through which the third lever (fixed to the window casement) carries out a horizontal feeding motion. In order to keep it simple, the lever system described above is called the 'main lever system'. Staggered to the main lever system there is an identical lever system, which is called an 'additional lever system' in order to differentiate it from the main lever system. The difference between both systems lies in the fact that the action lever 46 of the additional lever system is – at the end - fixed to the frame through a rotating pin 24 of a holder 45. The transfer of movement between the lever systems (the main lever system and the additional lever system) occurs through parallel arranged ropes and profile rods 37; 38. The parallel arranged ropes or the profile rods are connected in a suitable position to the action lever 46 of the main lever system and the action lever 46 of the additional lever system through a rotating pin 35; 36. The transfer of the movement between both systems can also occur through connecting rods and toothed rods as shown in the original model with individual levers. The movement of the parallel arranged ropes or profile rods transfers the movement of the action lever of the main lever system at the relevant actions lever of the additional lever system.

This makes it possible for the movement of the drive shaft (via the drive motor) to create movement of both action levers, which are connected with the main lever system. This creates a movement around the drive shaft and the parallel arranged ropes or profile rods move the action lever of the additional lever system, which forwards this movement to its swivel fixed pivot brackets. Every window casement has at least 4 lever systems: two main lever systems with drive shafts and two additional lever systems, which are fixed in their relevant holders to the frame or counter-frame of the window casement. The connection of the lever systems through parallel arranged ropes or profile rods enables a feeding motion of the window casement on parallel levels to the frame, which makes it possible to open and close the window.